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Progress in the Regeneration of the Prairie at the Iowa Lakeside Laboratory

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PROGRESS IN THE REGENERATION OF THE PRAIRIE AT THE IOWA LAKESIDE LABORATORY

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The prairie tract owned by the Iowa Lakeside Laboratory lies northwest of Miller's Bay, West Okoboji Lake, in Section 23, T. 99 N., R. XXXVII W., Dickson County, Iowa. It covers approximately sixty acres of irregular surface, which drains toward the southeast into the bay. There are several more or less prominent morainic knobs in the tract. Three springy places support hanging bogs, each with its little stream draining into the lake; another tiny bog has no outlet. A shallow pond on the extreme western edge of the tract has been drained by highway ditches and is practically extinct. The slopes are quite steep in many places. The knobs were from sixty to ninety feet above the lake level in 1934.

People who have been acquainted with the region for many years report that this tract has never been broken for cultivation. It was used for pasture and was pastured heavily until 1930, when the Lakeside Laboratory Association obtained possession of it. It has not been pastured since that year.

Eighty eight rods from the north boundary of the property is a very low, almost indiscernible ridge which seems to mark the position of a fence long since destroyed. South of this line there are practically no prairie plants, *Aster multiflorus* being the only one at all common. In the bluegrass sward there are many weeds, such as dandelions, verbena, timothy and small ragweed. Professor Shimek tells me that there was once a corral here where horses were kept. It is clear that the destruction of the prairie in this plot was more complete than elsewhere.

Pasturing has resulted in the partial destruction of the native plants and in the supplanting of them with pasture grasses and weeds, many of which are natives of Europe, carried by the white man wherever he goes. The nature of these weed floras in the prairie region has been discussed by Shimek (1925 and 1931). The condition which was brought about by grazing may be inferred by a record taken in 1935 in a pasture adjoining the laboratory tract. A meter-square quadrat yielded the following:

Trifolium repens L., approximately 60 per cent.

Poa pratensis L., approximately 30 - 35 per cent.
Ambrosia artemisiifolia L., approximately 120 small plants.
Verbena stricta Vent., 1 plant.
Euphorbia (a small species), 2 plants.

Other plants growing in the same pasture but scattered and inconspicuous were:

Achillea Millefolium L., *Cirsium canescens* Nutt., *Monarda mollis* L., *Koehleria cristata* (L.) Pers., *Bouteloua curtipendula* (Michx.) Torr., *Bouteloua hirsuta* Lag., *Antennaria* sp., *Aster multiflorus* Ait., *Anemone patens* var. *Wolfgangiana* (Bess.) Koch, *Petalostemum purpureum* (Vent.) Rydb., *Lepidium apetalum* Willd., *Salsola Kali* var. *tenuifolia* G. F. W. Mey., *Polygonum aviculare* L., *Hordeum jubatum* L., *Viola pedatifida* G. Don.

In 1931 Dr. A. P. Kelley, now of Malvern, Pennsylvania, began a study of the laboratory tract, and laid out two lines of quadrats traversing it from lake shore to boundary. He kindly furnished the writer with notes on his survey, so that all of these quadrats have been located.

In 1932 the writer spent five weeks at the Laboratory, but made no record of the prairie tract, beyond noting that it was mostly a thick sward of bluegrass with *Verbena stricta* and *Cirsium canescens* very conspicuous. The summers of 1934 and 1935 were both spent at the Lakeside Laboratory and the prairie tract made the subject of intensive study.

In 1934 the entire area was surveyed with a forester's transit and surveyor's chain. Slopes were measured with a hypsometer. Levels were checked with the aid of an aneroid barometer. This procedure is subject to error due to small but significant fluctuations in atmospheric pressure, but was helpful, nevertheless. A map was made of the area with contour lines sketched in at intervals of ten feet.

A list of plant species was made with an attempt to identify every one growing in the area. The general distribution of these into plant communities was noted and the position of the communities was sketched on the map. Part of Kelley's quadrats were located and records made of the plants found in them.

Exclusive of the hanging bogs and the streams that trickle from them the whole area supports only two types of plant communties. The first of these is a fairly pure stand of bluegrass which covers all the lower areas, not only the lower slopes leading down to the lake, but the broad, flat depressions which mark drainage lines on the higher part of the tract. This bluegrass forms a very compact sod, broken only by such deep-rooted and relatively inedible

prairie species as *Onosmodium occidentale, Cirsium canescens, Solidago rigida,* and *S. canadensis.* Intermingled with the bluegrass are such weeds as *Verbena stricta, Euphorbia glyptosperma, Hordeum jubatum, Ambrosia artemisiifolia* and *Taraxacum sp.* Such grasses as *Agropyron Smithii, Phleum pratense* and *Agrostis alba* are often found in this community.

The aggressive, hardy grass sometimes called *Poa pratensis,* var. *angustifolium* (L.) Sm. is by far the commonest plant in the entire tract. It is safe to say that there is not a square meter of the area without some of it. Its dense, creeping rootstocks grow among bunch grasses and *Petalostemum* on the dry knobs, and encroach on *Sagittaria* and willows in the edges of the bogs. The only plants that successfully compete with it are those that are tall and dense enough to destroy it by shading.

The second well-marked plant community is the prairie. On the side toward the lake especially, it is sharply demarked from the bluegrass, beginning somewhere between the forty and the sixty foot level and covering the tops of the knobs. On the rolling, higher ground the demarkation of bluegrass from prairie is not so clear, though even here the bluegrass is more in evidence in the lower places. Bluegrass is an important component of even the points where tall prairie grasses are most abundant, but is overtopped by them and rendered less conspicuous.

The prairie plants most frequent on this tract are as follows:

Andropogon provincialis Lam., *A. scoparius* Michx., *Aster multiflorus* Ait., *Bouteloua curtipendula* (Michx.) Torr., *Petalostemum purpureum* (Vent.) Rydb., *Solidago rigida* L., *Verbena stricta* Vent.

Others present in varying numbers are the following:

Agrostis alba L., *Allium stellatum* Ker, *Ambrosia artemisiifolia* L., *A. trifida* L., *Amorpha canescens* Pursh, *Anemone cylindrica* Gray, *A. patens,* var. *Wolfgangiana* (Bess.) Koch, *Artemisia caudata* Michx., *A. ludoviciana* Nutt., *Asclepias syriaca* L., *A. verticillata* L., *Astragalus caryocarpus* Ker, *A. hypoglottis* L., *A. canadensis* L., *Aster ptarmicoides* T. and G., *Bouteloua hirsuta* Lag., *B. oligostachya* (Nutt.) Torr. *Brauneria angustifolia* (DC) Heller, *Carex festucacea,* var. *brevior* (Dewey) Fernald, *Cirsium canescens* Nutt., *Elymus canadensis,* var. *robustus* (Scribn. and Sm.) Mack. and Bush, *Equisetum laevigatum* A. Br., *Erigeron ramosus* (Walt.) BSP., *Euphorbia glyptosperma* Engelm., *Galium boreale* L., *Hedeoma hispida* Pursh, *Helianthus grosseserratus* Martens, *H. scaberrimus* Ell., *Heuchera Richardsonii* R. Br., *Hordeum jubatum* L., *Koehleria cristata* (L.) Pers., *Lactuca canadensis* L., *Lepachys pinnata* (Vent.) T. and G., *Liatris sp., Lithospermum angustifolium* Michx., *Linum sulcatum* Riddell, *Muhlenbergia cuspidata* (Torr.) Rydb., *Oenothera biennis* L., *Oe. serrulata* Nutt., *Onosmodium occidentale* Mackenzie, *Oxalis filipes* Small, *Oxybaphus hirsutus* (Pursh)

Sweet, *Panicum oligosanthes*, var. *Scribnerianum* (Nash) Fernald, *P. Wilcoxianum* Vasey, *Petalostemum candidum* Michx., *Physalis heterophylla* Nees, *P. virginiana* Mill., *Potentilla arguta* Pursh, *Psoralea esculenta* Pursh, *Pycnanthemum virginianum* (L.) Durand and Jackson, *Rhus Toxicodendron* L., *Rosa pratincola* Greene, *Scrophularia leporella* Bicknell, *Solidago canadensis* L., *S. serotina* Ait., *S. Nemoralis* Ait., *Sporobolus asper* (Michx.) Kunth, *Stipa spartea* Trin., *Symphoricarpus occidentalis* Hook., *Viola pedatifida* G. Don.

Introduced plants found in this tract:

Achillea Millefolium L., *Agropyron repens* (L.) Beauv., *Avena sativa* L., *Melilotus alba* Desr., *M. officinalis* (L.) Lam., *Phleum pratense* L., *Polygonum Convolvulus* L., *Portulaca oleracea* L., *Setaria viridis* (L.) Beauv., *Taraxacum erythrospermum* Andrz., *T. officinale* Weber, *Tragopogon pratensis* L., *Trifolium pratense* L., *T. repens* L.

To the west and north of the Lakeside Laboratory property were formerly a number of ponds and kettleholes, all of which have been drained and turned into fields. No streams cross the highway but one or two of the drainage systems head back into the higher ground to the west. That there is a constant supply of ground water from this direction is shown by the fact that the hanging bogs on the laboratory tract are always wet. The effect of these drainage lines with their supply of underground water is reflected in the type of vegetation. In the more moist places the *Andropogon* gives way to tall composites such as *Solidago canadensis, S. serotina, Helianthus grosseserratus* and *Lepachys pinnata*. In these places along the fence are found grapes, *Vitis vulpina* L., and poison ivy, *Rhus Toxicodendron* L. The bluegrass in these lower places has an admixture of redtop, and *Ambrosia artemisiifolia* is replaced by *A. trifida*. This modification by ground water supplies reaches its extreme development in points on the tract where *Spartina pectinata* Link and *Scirpus atrovirens* Muhl. spring out of what appears to be dry prairie.

In the summer of 1935 a careful and systematic effort was made to locate all of the quadrats laid out by Kelley in 1931. Every quadrat was located this time. A record of each was taken with estimation of its coverage in percent, or where numbers were few individuals were counted. A comparison with records obtained on quadrats found in 1934 is of interest. These quadrats are three meters square.

QUADRAT A_6

1934 (list)	1935
Poa pratensis	*Poa pratensis* (sod)
Taraxacum officinale	*Trifolium repens*, 5 percent

Ambrosia artemisiifolia
Verbena stricta
Phleum pratense

Ambrosia artemisiifolia, 10 per cent
Taraxacum, 6 plants

Quadrat A_8

1934	1935
Poa pratensis	*Poa pratensis* (sod)
Taraxacum	*Phleum pratense*, 3 clumps
Large (*T. officinale?*) 10	*Ambrosia artemisiifolia*, 7 plants
Small (*T. erythrospermum?*) 62	*Taraxacum* sp., 14 plants
Phleum pratense	*Trifolium repens*, 1 plant
Verbena stricta	*Aster multiflorus*, 1 plant
Ambrosia artemisiifolia	
Aster (multiflorus?)	

Quadrat B_2

1934	1935
Poa pratensis	*Poa pratensis*, 60 per cent
Andropogon provincialis	*Andropogon provincialis*, 4 clumps
A. scoparius	*A. scoparius*, 4 clumps
Aster multiflorus	*Bouteloua curtipendula*, 5 clumps
Ambrosia artemisiifolia	*Ambrosia artemisiifolia*, 5 per cent
Taraxacum officinale	*Aster multiflorus*, 3 clumps
Panicum Wilcoxianum	*Cirsium canescens*, 2 flowering
Verbena stricta	16 seedlings
Solidago rigida	*Trifolium repens*, 3 plants
Bouteloua curtipendula	*Viola pedatifida*, 1 plant
Solidago canadensis	*Taraxacum* sp., 1 - 2 per cent
	Agropyron repens, 1 plant
	Verbena stricta, 1 flowering
	3 seedlings

Quadrat C_9

1934	1935
Poa pratensis	*Poa pratensis*, 50 per cent
Andropogon provincialis	*Andropogon provincialis*, 35 per cent
Viola pedatifida	*Viola pedatifida*, 4 plants
Cirsium canescens	*Cirsium canescens*, 2 flowering
Phleum pratense	17 seedlings
Agropyron Smithii	*Ambrosia artemisiifolia*, 5 per cent
Taraxacum officinale	*Bouteloua curtipendula*, 3 per cent
Euphorbia glyptosperma	
Verbena stricta	
Ambrosia artemisiifolia	

Quadrat C_{13}

1934	1935
Poa pratensis	*Poa pratensis*, 40 per cent
Agrostis alba	*Andropogon scoparius*, 30 per cent
Andropogon scoparius	*A. provincialis*, 4 clumps
A. provincialis	*Aster multiflorus*, 1 large plant

Panicum Wilcoxianum
Erigeron ramosus
Viola pedatifida
Solidago rigida
Verbena stricta
Aster multiflorus
Muhlenbergia cuspidata
Cirsium canescens
Bouteloua curtipendula
Taraxacum officinale
Ambrosia artemisiifolia
Amorpha canescens, 1 clump
Solidago rigida, 2 plants
Cirsium canescens, 1 large
6 - 7 small
Verbena stricta, 3 plants
Taraxacum sp., 8 plants
Ambrosia artemisiifolia, 5 per cent
Amorpha canescens, 1 plant
Viola pedatifida, 1 plant
Solidago nemoralis, 1 plant

Close to Quadrat C_{13} is a large granite boulder. Beside this boulder is a small clump of *Opuntia fragilis* (Nutt.) Haw. which I am told was transplanted from Gitchie Manitou State Park in 1931 by Dr. Kelley. In 1935 the bluegrass had almost smothered this little group of cactus. Another year or two will probably see its end.

The prairie tract on the Iowa Lakeside Laboratory property was never completely denuded. This is one factor which contributes to its value as a place for study. Bluegrass, which was thoroughly established when the tract was being pastured has grown vigorously since the pasturing ceased. It has produced a compact turf, with dense and high leaves, that is crowding out part of the weed flora, and offering stubborn resistence to invasion by taller native plants. At present the chief factor determining the outcome of this competition seems to be in the water supply. In the lower places the bluegrass is dominant, on the ridges and knobs it apparently is losing ground. In moister ground, as toward the lake shore, tall composites, characteristic of moist prairie, come in and shade it out. Bluegrass then represents middle ground between the extremely dry and extremely moist parts of the prairie, or as nearly mesic conditions as the area affords.

Changes in the present flora are slow. Some additional plants have been observed each year, partly due to the personal factor, but certainly in some instances due to actual increase. Among these is *Psoralea esculenta* of which less than a dozen plants were found in 1934. In 1935 they were more numerous; some plants matured seeds. An important observation in 1935 was the finding of four *Quercus macrocarpa* Michx. seedlings which were growing in one of the quadrats in the bluegrass. This is an invasion which will be interesting to watch.

Many plants common in the lake region have not been found growing on this tract in the past two summers. *Rosa pratincola*,

for example, is abundant around the cottages but rare on the prairie area. *Silphium laciniatum* L. and *Eryngium yuccifolium* Michx. grow in great numbers on the Lookout west of the Laboratory, but neither is present on the Laboratory property. *Liatris* species are notably scarce. *Psoralea argophylla* Pursh and *Asclepias Sullivantii* Engelm. are represented by small colonies along the road to the north, just outside the fence. The appearance of these and many others as migrants into the tract is an interesting prospect for the future. Shimek (1925) says that in 135 species of vascular plants found on the Laboratory prairie and on the Lookout only 54 were common to both. This he attributes to accident of distribution and not to any observed differences in the two areas.

This report is by no means complete. Visits in the spring and fall have not been feasible. Plants missed in this report on account of early and late flowering periods are few. Most of them are the ones which border on moist areas, such as an Aster, tentatively identified as *A. puniceus*, var. *lucidulus* Gray.

Summary

1. The regeneration of prairie on the Iowa Lakeside Laboratory property has reached the condition where the prairie species which survived grazing have become well developed on knobs and higher ground, also on extremely moist places.

2. The bluegrass sod induced by grazing is still dominant over much of the area, especially on moist, but well drained areas.

3. Due to competition by perennial grasses certain members of the weed flora are decreasing in number. This is also true of *Opuntia fragilis* which was transplanted to the Laboratory tract.

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